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THE PHILOSOPHY OF SCEPTICISM.

[Delivered by Chas. F. Coffin, of Indiana, awarded the first prize at the Inter-State Oratorical Contest, at Jacksonville, Illinois.]

It has been justly said that the shadow of riches is poverty, the shadow of power is slavery, the shadow of virtue is vice; and with equal justice it may be said that the shadow of belief is skepticism.

England had her Jeremy Taylor and her David Hume; France her Pascal and her Voltaire; America her David Cook and her Robert Ingersoll.

How does it occur, and what does it mean, that these two great intellectual forces are so often found together? Does it mean that they are related as cause and effect? Does it mean that faith can be purchased only by paying the fearful price of skepticism? With such vital questions as these confronting us, it is of the highest importance that we examine candidly the relation of Skepticism to Theology.

As a common ground "from which to reason and to which refer," it will perhaps be admitted that law prevails in the realm of mind no less than in the realm of matter, and that mental phenomena, no less than physical, should be interpreted in the light of rational principles.

For no general phase of human thought, whether it relate to government, philosophy, or to religion, ever sprang spontaneously into being; but every current theory of state, every doctrine of modern philosophy, every tenet of mordern theology, is the outcome of the slow and toilsome growth of ages. And each in turn represents centuries of of human thought, centuries of human experience, centuries of human suffering. If over the soil of fair America to-day a proud republic waves her flag, it is because out of the terrible conflict of the past, out of tyrannies of despots and rebellions of the oppressed, out of the decay of states and the disasters of revolutions, there was born and flourished in human consciousness the idea of self-government. If the philosophy of to-day is broad and deep and rational, it is because it is the quintessence of the yearnings and the strugglings which, since the dawn of history, have impelled the human mind to search for the unknown. And just so, I take it, is scepticism the outgrowth of certain antecedent mental forces which may be ascertained and classified, just as the forces which produced the Protestant Reformation. The French Revelution or the American Rebellion may be ascertained and classified. The demonstration of this in-

volves a consideration of the law of human growth, the method of human progress. In this, man differs widely from nature. In nature there are no epochs; no conflicts between the conservative and the radical. She has no revolutions, no reformations. The shuttle of her mighty loom moves incessantly to and fro, and now she weaves a rose, and now a lion, and now a man; but all is quiet, gradual, uniform.

With man, progress has been a ceaseless conflict between the radical tendencies of thought and the conservative tendencies of institutions; between the gradual unfolding of human consciousness and the stubborn fixedness of the organic forms of civilization. Indeed, human progress is not unlike a volcanic eruption. For a long time while the opened-mouthed mountain stands out against the sky, a dead, harmless mass of rocks and earth. Yet down in the subterranean caverns at its base the volcanic fires roll, and hiss, and sputter, till at last, no longer able to be confined, they rush forth in ungovernable fury. The sky is first reddened with flame, then darkened with clouds of ashes, rivers of molten lava pour over the country, devastating fields and destroying cities. So human thought, smothered by oppression, goes on, dimnly defined and unexpressed in the great brain of humanity, till by a co-incident development of like thoughts and tendencies, like passions and feelings, it breaks out and defiantly laughs conservatism and tyranny to scorn. Old institutions are suddenly swept away; old modes of thought are discredited. The human charriot, deep in the rut, are lifted out and placed on a new highway. New relations are formed, new institutions are created; and these in turn become the conservators of past development and the barriers to future progress till another crisis comes and another revolution solves the problem.

The human mind is so constituted that when compelled by external or arbitrary power to bide any extreme of thought, sooner or later it will escape from the bonds of authority, and on the principle of the equality of action and reaction, rush to the opposite extreme. What was Voltaire? He was a reaction. What was David Hume? He was a reaction. What is Robert Ingersoll? He is a reaction. These men, sceptics though they are, and censure them as we may, are nevertheless martyrs to the inexorable law of their own being, and the irresistible law of human progress, They are to a great extent created and destroyed by their own environment. And so long as progress shall be by revolutions, it will have its victims, its brutalities, its social and intellectual ostracisms, its smoking stakes, its clanking chains, its times of fire and blood.

It is in the light of human history, and in the light of psychological law of reaction; that scepticism is largely traceable to the antagonism between man's religious consciousness and his religious institutions,—I may say, between the progressive tendency of the religious spirit which is in man and the conservative tendency of his theology. For while most of the great sciences have been studied with almost perfect freedom, and have been open to perpetual revision, theology, has, to a great extent, been studied in fetters. The students of the other sciences have sought facts, their use, their meaning, their law; they have acknowledged pre-established standards; they have been bound by no traditions; they have been employed no Procrustean beds on which to torture idea. Reluctant as we may be to admit it, so much can scarcely be claimed for theology as a science. It has frequently resisted all growth and developments of its creeds. The aim of theologians has too often been, not so much to express the highest, the freshest, and the purest religious thoughts of a particular age, as to formulate a system of theology which should be final; to establish some external standard by which theories of ethics and forms of doctrines could be tested as by some mechanical process. The result is inevitable. Sooner or later a conflict arises between thought and dogma. Doctrines are still avowed and defended that so unsatisfactory to right and reason and so far behind the development of man's religious nature, and thinking men are repelled from the church and are led to doubt, to

criticise, to deny. Therefore it is this conflict between the conservative spirit of theology and the progressive tendency of religious thought; and also in the fear of the church to allow the human mind full sweep in its investigations and inquiries, that we find the genesis, the philosophy, indeed, of scepticism.

Having diagnosed the disease, do we pronounce it fatal, or is there yet hope? Must scepticism continue to be the skulking shadow of belief? continue to darken the lives and future anticipations of so large a part of humanity? It is, and must it ever be, as the great essayist has said, the very "Nemesis of faith?" Or may we not expect to see this grim monster vanish before the enduring light of truth?

Listen to the answer borne on the winds from all parts of the earth. Yes, there is hope. In the name of sturdy Germany, there is hope. In the name of brilliant France, there is hope. In the name of modern India, Africa, and Japan, there is hope. In the name of the God of Nations, there is hope.

But the remedy for scepticism must be based on the nature of its cause. Theologians must abandon the cherished idea of a final system of theology. So long as there is an undiscovered fact in the universe, so long as human nature is subject to growth, so long as there are imperfections in the human mind, there can be no government of man by rule, there can be no law which does not admit of a doubt in its application; and concerning the Beyond, there can be no creed which precludes the possibility of change. In the march of the finite towards the infinite, there can be no halting place till humanity, "Above the low-hanging clouds, like mountain peaks that look forever into the face of the clear blue heavens and gaze on the unsetting stars, shall look up into the face Divine and dwell among the principles that are unchangeable and eternal."

Furthermore, the church must throw open the doors of free inquiry. Nothing is more fatal to error, and more serviceable to truth, than investigation. And nothing so protects error and so hinders truth as the fear and suppression of investigation. The brave men who are willing to bear the pain of honest thought, must sacrifice their prejudices and have great havoc made with their fondly cherished illusions. But there can be no permanent value in a false position. Though a temple be builded as broad as the earth and as high as the heavens, and though its vaulted dome glitter with all the wealth of Ormus and of Ind, yet if its foundations be in the sand, the "eternal movements of the Divine floods will sometime undermine it and sweep it away."

The fatal mistake made by the Roman Church was the suppression of individual thought. It granted no liberty. It encouraged no freedom. It shut the Bible. It imprisoned the mind. It scowled upon invention and discovery with a baleful and malignant eye. And although the Reformation broke the power of this absolute intellectual tyranny, and started the swell of a revolutionary wave which broke only when its agitated waters kissed the peaceful shores of liberty-loving America, yet so thoroughly was the very atmosphere permeated with the spirit of intolerance, that to the present day there is more or less a confict between the men of science and the men of religion.

Until this discordant element is cast out; until the free reading of the book of nature is accompanied by the free reading of the Book of God, the voice of the scoffer and of the sceptic will not be hushed. America stands in the front rank to-day, guarding the very out-posts of religious freedom, and with anxious vision she gazes towards the citadels of Europe, and with bated breath she asks: "Watchman, what of the night?" She cannot mistake the answer: "Lo! the morn appeareth." Christian men are occupying the posts of the enemy. Christian men sweep the star-sown fields of space with their telescopes and know, of a truth, that "The Heavens declare the glory of God." Christian men, with hammer and microscope study the mysteries of the rocks and the wonders of the deep. The church is beginning "to prove all things." With an army of trained thinkers in her service—with her

Lotzes, her Presenses, her Cookes, and her Hopkinses—she is pushing her investigations in every direction and into every province of thought. She is rapidly pushing her way up through the clouds of superstition, through the mists of error and ignorance, to the lofty heights of Christian scholarship, from which, with purified vision she can sweep across the whole realm of thought and view things in their right positions and true relations. As Savage says, she is beginning to understand that, "just as all life, whether it reveals itself in the viscous globule that palpitates in primeval seas, in the lichen that creeps over the rocks, up through the ascending forms of plant and animal, until you reach the infinitely involved brain of a Newton, solving a problem in calculus"—has its source in the one creature, God of the Universe; and so all truth, whether it be the Vedas of Brahmin, the Koran of Mohammed, or the Bible of the Christian, whether it be on the banks of Ganges of Jordan, in the valley of the Tigris or Nile, it, too, is from God. When these grand conceptions shall have been realized in human consciousness—and they will be—when faith and reason shall join hands, and call upon the Author of all truth to sanctify the union—and they will do so—then we may expect the progress of man to become like the truth of nature. Revolution will no longer call for the sacrifice of human blood. If a dogma shall become obsolete, or a constitution cease to express the will of the people, change will no longer mean the marshaling of armies on the field of battle; it will no longer mean the carnage of Austerlitz and Waterloo, of Bunker Hill and Yorktown. It will no longer mean the beheading of Charles I., or the assassination of Alexander II., but the old will be merged into the new as quietly as an Artic summer night breaks into dawn; as peacefully as "sudden blooming of the flowers, or the sudden softening of the air." Relsgirus institutions will grow with the growth and expand with the expansion of man's moral and religious nature. Scepticism robbed of the very soil in which to sow its seed spectre-like, shall vanish away; and by the side of tyranny, oppression, and intolerance, it shall lie down to its eternal doom—

"Unwept, Unhonored, and Unsung."

ALUMNI.

On the evening of June 28th the Alumni held their meeting in the college chapel. While there were not as many of the members present as we hoped to see, yet to see the hearty greeting of class-mates and schoolmates when meeting at their "Alma Mater," was to us a pleasure. It made us look forward to a time when we hope to be counted among the number, and not be compelled to be a silent spectator.

Everything passed off quite pleasantly during the day, and at eight o'clock in the evening, Prof. J. K. Macomber, the president of the association, quietly called the house to order and with a few well chosen words, welcomed the alumni. He then called for a piece of music by Mrs. Genevieve Barstow, class '79 and W. K. Robbins, of class '78. They, with much credit to themselves, favored the audience with the piano and violin duet "Amaryllis." W. A. Helsel, class '77, was then introduced as orator for the evening.

Mr. Helsel then presented to us the theme, "Practical Men." He told us that his time had been largely occupied with his business of late, ond consequently he could not dispense entirely with his manuscript.

During the address, which was an earnest appeal to all, to devote themselves to progress, he showed us that the governing impulse has been, and is now, to a great extent, pleasure. To this he does not object if the pleasure be of such a nature that it is at once instructive and elevating. The call for practical education as viewed by many arises not from any intention to cultivate one faculty of mind at the expense of another, but from a misconception of the true education. Cultivating all the intellectual faculties, prepares us for living true lives, 10 years of which equal a century of mere existence. We must be able to look after the necessities of life. We ought to cultivate the finer feelings. Every man should

be his own master; every person should be a thinker. When independent thinking is cultivated, society will contain more practical, high-minded men. Mr. Helsell seemed to be perfectly at home on the stage and his production was well received by the audience.

The historian, Mr. J. N. Muncey, of class '78, then came forward and in a clear, forcible and pleasant manner, furnished us the most complete history of the alumni that we have ever heard. Mr. Muncey seems to have taken great pains to collect all that would likely be of interest to the Alumni and students, and in our opinion he succeeded admirably. We will not attempt a review, but will endeavor to obtain it for the next issue.

Mrs. Barstow and Mr. Robbins then rendered the duet "Gavotte," and the applause which followed showed the appreciation of it. This closed the session and soon after the Alumni were invited to partake of an ample supper in the dining hall. On the whole the occasion was a very enjoyable one and everything passed off quite pleasantly.

JUNIOR EXHIBITION.

The chapel decorations deserve a description in detail. We can only mention, however, that Mr. Colby's design was a new and pleasing departure from the old style of decorations.

To give a correct estimation of the relative merits of productions, a critical review must be elaborate, liberal and accurate. Space has always forbidden this. One word —Our appreciative nature is dependen upon the law of the association of ideas, which has a greater or less tendency to pervert our judgment. Further, even the most unbiased opinion tends, frequently, to create offense. And why? Because, as Americans, we are not accustomed to being pointed to our defects. It should not be so. In our opinion a step should be taken in public schools and colleges to educate students to willingly accept all criticisms which are attended by an honest purpose of the critic.

Notwithstanding that the remembrances of years are fresh in our memories, we do not believe that there is any honor bestowed upon undergraduates who aid in publishing such scurrilous and worthless mock programmes. They have always been a disgrace to the authors, and a disgrace to the instition. Now we sincerely hope, that in future years students will not seek that kind of culture and applause.

After the invocation by Rev. ———, and the chorus, "O, Hush Thee," by twenty-five well trained voices, we listened to a good oration by Mr. C. F. Saylor.

Mr. Saylor claimed that "The True Quest" in life is to solve the problem of our present and future existence. Throughout, the oration evinced indiviuality of thought. The sentences were smooth, well balanced, climatic and oratorical. His language is accurate, full of meaning and void of the ornate. The oration itself is a highly commendable production. But with an unnatural and strained pitch of the voice, and too much haste, the thought did not excite the attention it so justly deserved. He dwelt at some length upon the radical and conservative habits that are so deeply rooted in human nature, and estimated liberally the practical value of each. He insisted that "the true study of art is the study of man," and said, "we recognize the physical courage of a hero, and laud his name until fame carves it on the invincible rock of ages, where it remains to invite posterity on to mighty deeds, while in the silent chambers of imagination there exists a moral courage noted only for meekness, but the true cause of all heroic deeds." In justice to the oration further quotation should be made but space forbids.

Miss Nellie Merrill followed on the subject, "The Cultured Eye," in which she clearly set forth the fact, that the marked difference in the observation of educated men is to be ascribed to the reactive effect culture has on the organs of vision. She held that it requires a cultured eye to see all the beauty in external objects; and by a number of examples set forth the importance of culture in directing man to make correct observations. "Would you be a fathful gleaner in the fields before you?

have your thoughts and actions purified by true and noble examples? Then attend well to the culture of the eye, for in this lies your strength, your prospects of living to some purpose by the perception of the moral beauty that is in God's creation, and your power to leave behind you monuments that will be imperishable."

The instrumental solo, "Il Parita," by Mr. Shaw, was, in the estimation of good critics, most beautifully rendered.

Mr. W. W. Wheeler then gained the close and steady attention of the entire audience in speaking upon "The Power of Language." Mr. Wheeler presented in a clear and forcible style, the high estimation every age and nation placed upon relics of literature, and cited examples to prove true the statement. He supported in eloquent words the English language. History, poetry, orators and oratory received at his hand a just proportion of merit in promoting the growth and improving the stucture of the English language. He said "When we leave the domain of ancient classics and delve among other sources for our powers of expression, we must bid farewell to the teachings of Latin, leave unfathomed the euphonic powers of the Greek tongue, and, borne by the wings of time over a decade of centuries, we will at last be anchored in the golden fields of our own vernacular, which stands at the head of all living tongues. Though less musical than the Italian, less definite in structure than the German, less sarcastic than the French, and incapable of uniform elevation as it may be, yet with a compass equal to them all, it knocks at the door of conscience, unveils the darkness of sin and pours in the light of the Divinity to such an extent as no other tongue can imitate. no other language can sound."

He closed amid loud, hearty and honest applause of the audience. This alone is evidence of their appreciation of his production. There were, however, some defects in the delivery, occasioned by embarrassment.

Miss Sarah E. Smith next delivered a beautifully finished speech on the subject, 'Unrest," in which she clearly presented the fact that, throughout all ages, the geniuses have, aside from their own inherent ability, received their greatest impulses amid storm, opposition, reform and revolution. "What was the spirit of discovery? Was it a result of quiet and satisfaction? No! The impulse that set on foot the discoveries of the Egyptians, the adventures of Cooke, Magellan, Columbus, Drake, the many dangerous expeditions to the North Sea, was the intense longing to see more, do more, know more. Much is due to the physical unrest of man for discovery."

Mr. H. J. Gable then spoke on "Industrial Education" and dwelt in strictly argumentative style and delivery on the importance of the practical. "An education to protect its recipient against the blunders of ignorance and the greed of his fellow men. It must bring into peaceful harmony the labor exerted by the brain and the labor exerted by the mind. To aspire to a symmetrical and well-balanced culture of all human faculties rather than a training which cultivates one set and leaves the remaining ones to accidents and atrophy."

Notwithstanding his displayed art in his gestures, and some monotony occasioned by a sameness of voice, he argued in an unembarrassed manner for the highest and most liberal education.

The German duet "Abschied der Schwalben," sung by Misses Belden and Fiegenbaum, received the most hearty applause of the evening.

Miss Kittie Reeves then delivered a carefully prepared oration on "Environment." She justly estimated the effect of society upon the intellectual growth of its individuals, and plainly proved that the peculiarity of mental growth is due to the conditions presented to mind by that society.

Mr. E. A. McDonald followed with a splendid oration on "Ignorance, the Basis of Despotism." Mr. McDonald is as argumentative as he is eloquent. His unequalled ease and grace in delivery, his adaptation of the voice to the sentiment, the clearness and precision of the language and above all the unity of thought, entitles him

to a position among the best orations of the evening.

Ignorance not alone of an age, when art, invention and industry were in their infancy, but ignorance as it localizes itself among the people of modern times. Abundant historical examples were brought forward with a view to prove the truth of his proposition.

The piano duet by Misses Athearn and Minnie Knapp, next claimed the attention of the audience. Good critics pronounced it very finely executed.

Miss Luna Farwell's oration on "Self-worship" was a departure from the ordinary manner of treating that subject. She dwelt upon the importance of holding a correct estimate of our own individuality and ability. As soon as a man begins to lower himself in his own estimation, he begins to cease struggling for higher attainments in the department of thought he once loved.

Miss Nellie Coe on "Storming of the Bastile." This oration bordering now and then on the dramatic, yet necessarily so, claims superiority in the forcibleness of its style, the simplicity of language, continuity of thought and the vividness with which it depicts the pictures of riot, war and bloodshed. An extract can give but little conception of its true merit. "The day for storming the Bastile dawns, and Paris is alive; at every corner is a group arguing, gesticulating, rushing, tramping. Here and there a murmur, a sound, a daring voice, and the cry is everywhere, "To the Bastile!" "To the Bastile!" But the people are without arms. and the prison is guarded; cannon in every embrasure; walls nine feet thick, a wide, yawning ditch, a defiant barrier, sixty feet high, drawbridges and arched gateway—truly without arms, the crowd are powerless. * * * * Soldiers are sent to aid the governor but cannot gain entrance. Crowds of the populace draw nearer. Wilder swells the tumult. The outer drawbridge is taken, and the beseigers pass on. The aged prisoners in the cells of the Bastile listen and know not."

Her timely gestures, her clear, full voice, though occasionally a lack of confidence in the tone, the exciting style of language, and the exceedingly good delivery, rendered the oration interesting and instructive.

Mr. W. S. Summers certainly gave a most excellent oration on "The Eccentric in Literature." Subtract the few unpleasant attitudes from his delivery, and in our estimation, he justly receives the title, the honor oration of the evening. The power, truth, and depth of his thought, the elegance of his language, and in general the ease of his delivery are deserving of much praise. When referring to Carlyle, he says, "Place by his side Disraeli, the Oriental Jew, who knows man and how to flatter him. Study them analytically, and discover their peculiar mental traits. Reveal the motives of their action and the degree of success attained by each. Carlyle is pre-eminently liberal. Disraeli is emphatically conservative. Carlyle is profound, philosophic and analytic. Disraeli is acute, sagacious and theoretic. Carlyle is ardent, energetic and sanguine. Disraeli is cold, apathetic and cynical. Carlyle is a consummate master of details. Disraeli abhors them. Carlyle undertakes to demonstrate. Disraeli attempts to conciliate. Carlyle has no element of cunning duplicity. Disraeli plans to subject everything to the beck and nod of his own caprice. Carlyle is governed by principle. Disraeli acts from policy.

The class of '82 msy juatly feel proud of their exhibition. The only thing which marred the pleasure of the evening's entertainment was a deep, groaning sound made by an uncultured young man in the back part of the audience. This student is deserving of the severest censure. It only occurred twice and then this repulsive tone proved that he was ashamed of himself.

In conclusion it may be justly said that the exhibition equals if not surpasses any to which we have listened. There was not a single hesitation, omission or failure. And the attention of the audience is the strongest evidence of the just appreciation of the evening's entertainment.

SCIENTIFIC.

USES OF THE MICROSCOPE.

It may seem unnecessary to discuss here the uses of an instrument which has become an essential in so many branches of art and science, but the fact that its value is not so widely recognized, or its advantages so generally used as it seems to me they should be, may serve as my apology. That this is the case is probably due to the fact that without a certain amount of skill in its use, it is valueless, and to attain this requires more labor and study than many are willing to devote to it. Besides this, from the extravagant expressions of some enthusiasts, (or possibly some dealer in toy miscroscopes) many people are led to believe that it is an instrument of most wonderful powers, and once in their hands they have the key to all the wonders of the universe. Such expectations must always be doomed to disappointment, and the disappointed person turns from the miscroscope in disgust, his faith in it shattered, perhaps beyond recovery.

The uses of the microscope may be considered under two heads. First, as an essential aid in various arts and professions, and, second, as a means of research, discovery, and education. Prominent among the arts which could not exist in their present advancement without this assistance we may name watch-making, engraving, type-making, and photography, and the importance of any of these, which need only to be mentioned to be appreciated, may serve to measure the advantages which microscopy has brought to the world.

In law the microscope plays no ipsignifi cant part, for in the detection of forgeries, adulterations, counterfeits and other crimes it is one of the most important elements. In murder trials the testimony of the microscope may be sufficient to convict the guilty or acquit the innocent, for while it is not possible to distinguish human blood corpuscles from those of all other animals, it is possible to distinguish them from those of a number of common animals and within these limits positive evidence can be given. It is evident that any element which may render the detection of crime of any kind more certain, renders each individual a little less liable to injury. Adulterations of foods would be far less frequent if purchasers were prepared to make even the very simple test required in some cases in order to prove the genuineness of their purchase. The same will apply to many other articles of commerce.

It is in the practice of medicine, however, that the microscope finds its widest and most valuable practical application, or at least it is here that it has been utilized to the greatest extent. Surely no work deserves greater honor than that of rendering aid to the alleviation of human suffering.

We may give as instances, in this connection, diseases due to parasites, either external or internal, and which require the aid of the microscope in their diagnosis. Numerous skin diseases, due to either animal or vegetable parasites, cannot possibly be treated without its use. *Trichinosis* would forever have remained a mystery without the microscope, and its victims have been continually drugged for a thousand and one diseases that had not the slightest relation to their symptoms. And not only in ascertaining its cause, but in its immediate treatment the microscope is indispensible. In diseases of the kidneys the microscope is particularly essential to correct treatment. Bright's disease cannot pssibly be properly diagnosed without its assistance. In furnishing accurate knowledge of diseases the microscope has done more than any other means, and we think that all will agree that upon accurate knowledge of a disease depends the success of its treatment. In all diseases involving pathological changes, the causes and conditions of the disease must have remained unknown without its use. The microscope, indeed, has become such a necessity to the medical profession that a physician to-day, who would pretend to go into practice without its use would be as foolish as a farmer who would pretend, while refusing its aid, to compete with the modern machinery of the farm, or an engineer who would attempt the works of modern engineering

while refusing to use the instruments with which it works.

But it is to the microscope as a means of investigation, discovery and education that I wish particularly to call attention. Reference has already been made to its use in medicine as revealing the causes of certain diseases, but we may go still farther and say that without its use in disclosing the structure of various tissues upon which depends the action of various drugs, the practice of medicine could be but a blind operation in which practitioner must rely solely upon previous experience or chance. The advancement of histological science has placed the physician's art upon a solid basis, and the value of its disclosures and the necessity of its aid are recognized and appreciated by every progressive member of that profession.

In economic botany and entomology the microscope is of paramount importance, indeed, it can reasonably be doubted whether either of these sciences, with all their valued applications to human needs, could ever have existed had not this instrument been at hand to aid them in their researches. To substantiate this, I need only ask, what would ever have been known of the innumerable plants and insects, too small to be studied by the unaided eye, had not this instrument of investigation been at hand? Vegetable organisms, whose numbers are only less surprising than the minuteness of their size, infest almost every form of life, both vegetable and animal, and often with fatal results. Man, alone, is subject to their attacks in almost every portion of his body, while their effect upon field crops, orchards and forests is simply incalculable. The same is true in entomology, and there is no department in this science, theoretical or applied, in which the microscope does not figure. Classification would be impossible; the study of injurious forms and their effects equally so, while the first steps in gross anatomy, even, require its aid. Hundreds of special instances could be cited to bear out these general statements, but it is unnecessary, even were the limits of this paper sufficient to allow it. Biological science has progressed almost in an exact proportion as the microscope has been improved, and furnished a more perfect and accurate means of studying life. With the discovery of the *cell*, which could not have been done without the microscope and which is the foundation of biological science, began a new era in human thought, a new conception of life and its wonderful properties and powers, a new philosophy of life destined to supplant the mythical and dogmatical ideas of the past, and to plant truth and reason in place of error and superstition.

Lastly, we wish to consider the use of the microscope as a means of education, and by education is meant that broad culture, that training both mental and physical, which shall enable the individual best to cope with the world as he finds and it to meet the duties of life prepared to execute them to the very best advantage. Is this best obtained by the simple perusal of books? Shall we leave untutored the perceptive faculties? Shall we trust to nature to cultivate all the powers of observation which are absolutely indispensable to the success of an individual in any calling? Most emphatically, No. Looking, then, for some means by which to cultivate the powers of observation; to render the eye quick to see and the mind prompt to draw accurate conclusions; to give rapidity of action and delicacy of touch, and, above all, to impress the necessity of carefulness and thoroughness in any and every work undertaken, which is the basis of success in any vocation: looking for these qualities, we may certainly find them largely presented in the microscope, and hence I will claim it is one of the best means, (mark, I do not say the *only* means) for furnishing a full and true education. Such education I fully believe a *practical* advantage to any nation, for any means which renders greater efficiency in labor, greater activity in thought, and greater appreciation of truth must materially advance, not only the commercial interests of the country, but its intellectual and moral interests as well. H. O.

DISSIPATION OF ENERGY.

J. S. D.

By the term energy, in the general acceptance of the term, is meant the capacity for producing physical change. We shall here try to investigate the source, or sources, of energy, and the conditions that tend towards its final dissipation. The ways in which energy is manifested are of course too numerous to allow an investigation of each particular case; we shall only review a few of the best established physical laws and from these draw our conclusions.

It is admitted, I believe, by all physicists, that energy, of whatever kind, may be reduced finally to heat. The sources of heat as generally given are three, viz: mechanical chemical, and physical. A little consideration will shows that these are not independent. It is beyond all question that mechanical heat is traced to physical sources, that chemical energy can also be traced to the same source, and you will readily see that, without any external interference, chemical action would be of little avail in producing the grand round of changes through which the materials about us pass.

Beginning with plant life we at once see that heat is necessary to produce it. The influence of light and heat on plants appears to be exerted in bringing about a higher mode of chemical combination of the elements constituting the plant. During this process the plant is storing up a certain amount of material. It is also withdrawing from circulation a certain amount of force. In this process nothing is gained or lost, when the plant decays it returns to the inorganic world the material derived from it, and to the universe the heat or energy required to combine the elements. But in no way does the plant create heat or force of any kind. In the animal kingdom we find the same laws prevailing. The difference being the plant is constructive, the animal destructive in their actions on compounds. Thus through all the vegetable and animal kingdoms we find that no energy is gained or lost.

In chemistry it is a well known fact that the atoms of strongest affinity tend to unite with each other. Now were all the elements free, that this process might go on without hinderance, it is evident that they would all be united in accordance with this law. Then, before any other change could take place, they must be separated by some external agent. The agents that do separate these are animal and vegetable organisms. But as we have seen these organisms are due to heat, as all meteorological, chemical and mechanical action, and no matter what phenomenon we take, we can trace it back to this one underlying cause, we are brought to the conclusion that heat is the one underlying cause of all physical phenomena, and the source of all heat, as regards the earth, is primarily, or ultimately the same. To this we must make the following exceptions, or modifications. It can not be shown that motion of the planets on their axis and in their orbits are due to the action of heat. The nebular hypothesis, however, makes these motions dependent on the action of heat, being an unequal cooling of the primary mass. It will have to be observed that the primary source of heat, itself, is due to the attraction of gravitation, for, when we trace it back, we see that heat can only be accounted for by the falling together of the particles of the original mass. But once having the heat generated, we see that heat is the most active agent in producing the different phenomena. There is another case where heat is not the cause and that is the tide. These we will discuss further on, and with this understanding will proceed to the discussion of heat.

It is a law of heat that it always tends to pass from bodies of a higher to those of a lower temperature, and two or more bodies placed near each other will radiate and absorb heat in such a manner that they finally attain the same temperature, at which they will remain until disturbed by some external cause. Thus it is with the sun and its surroundings. It is constantly radiating heat. What becomes of it? That part received by the earth is not retained, as a study of the earth shows that its temperature does not increase. Then this heat must be again radiated. We say that it is radiated in-

to space, and further than this we do not know. I think that all experiments go to show, that heat when once absorbed, is always changed from high to low temperature, and it can not, by any direct means be changed back to high temperature. Heat, now to do work, must be of high temperature.

Then we can safely say this, heat is, to a great extent lost. It cannot be used in the process of vegetation, for here, as elsewhere there must be difference between the temperature of the plant and the outside heat before any change can be produced. When radiated from the earth heat must be either absorbed by something or it must be simply diffused in space. In either case it is useless, for it has been reduced to a state in which it is powerless to longer act as an agent of motion.

The conclusion that we arrive at then, is that all physical change, not only of the earth, but of the solar system, (excepting the cases metioned) depends on the sun's heat. The question is, how long will this last. This, as yet, we cannot tell, but suffice it to say there are no physical laws better understood than those of heat, and the inevitable conclusion is that all the heat of the universe will finally become dissipated and all parts be at the same temperature. Then will be an end of all change dependent on heat. We suppose the motions of the planets and all bodies in the universe was caused by the combined effect of attraction and unequal cooling of the original mass. We know of no cause that tends to keep them in motion, but do know what tends to stop them. This is their mutual attraction. This is well understood by the action of tides on the earth. The tides moving in an opposite direction to the motion of the earth must strike with tremenduous force against the continents, and here must stop the earth's rotation unless equalized by some, as yet unknown, cause.

That this same action is extended to all bodies of the solar system, is proved by the disturbance planets cause in the motion of others. That it extends to all bodies of the universe can not be reasonably disputed. We now see that we have a cause which accounts for a cessation of all physical phenomenon with which we are acquainted. For not only will the changes on the planets cease and their revolutions be stopped, but on the same ground they must all finally accumulate in one central mass. What length of time must elapse before the final equilibration of heat and the ultimate effect of attraction are finished no one claims to know.

It has been well said, "Subjects such as these, though of a kind on which the mind delights to speculate, appear, with reference to any hope of obtaining reliable knowledge, far beyond the reach of any present or immediately prospective capacity of man."

MISCELLANY.

It is said that steel may be made very hard by heating it slightly, immersing it in a composition of wheat flour, salt and water, and then heating it to a cherry red and plunging it into soft water.

A new integrating machine has been invented by C. B. Boys, of the Royal School of Mines, London. All the machines for this purpose heretofore invented have not performed the work in a mathematical way; but the invention of Mr. Boys is said to be based on strictly mathematical principles, and to be an exact translation of the mathematical method of integration.

M. Faye shows that the English mile has been reduced from the measure of Ptolemy who followed Eratosthenes and verified his measurements of a terrestrial degree. He shows that the error of one-sixth in the English mile is solely due to the fact that the Greek foot has been confounded with the Phileterian foot.

Mr. E. A. McDonald, who gauges the weather at the I. A. C., informs us that in the month of June, up to the 29th, we had 18 showers with a total rainfall of 6.9 inches. The heaviest rainfall was on the 11th, when 1.7 inches fell in 1 hour and 30 minutes. The highest temperature noted was on the 28th when the thermometer indicated 91° in the shade.

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THE AURORA, AMES, IOWA.

One more Junior Exhibition has been added to those of the past, and class '82 can breathe a sigh of relief, considering that it has performed this duty creditably. This exhibition, which, more than other public exercises, reveals the orators of a class, shows that '82 has several speakers of no meagre ability. One very noticeably feature was that half of the speakers were ladies, a fact of which very few classes can boast.

Our College should have five hundred students in regular attendance. Counting as other Colleges do, our number may be reckoned somewhere in the vicinity of three hundred. Those who complain that there are not five hundred students at the Agricultural College, when there are abundant facilities and teaching force for such a number, should consider two things: first, that we have been struggling for years to get dormitory accommodations on the grounds for the increasing numbers who apply, and the legislature has for some reason been stingy and parsimonious in its appropriations. Then, secondly, there prevails through the state a most stupid, incorrigible misapprehension of the nature and design of the College which renders it unpopular with the great body of our educating youths. It is looked upon, and spoken of everywhere as a place for making farmers, when any one with a spark of knowledge of the enterprise is aware that neither in theooy nor in practice can it be so construed.

It is not a technical school, and the law could not be twisted to admit of such organization. And yet the great body of the members of our legislatures, year after year, continue to talk of the school and legislate for it, as if it were an agricultural station, or something a very little different from that. And so they elect Boards of Trustees who have imbibed the same opinion.

This is a school for teaching the sciences that bear on the industries of life, and long ago the Bureau of Education warned the states against calling this class of schools Agricultural Colleges, on the ground that they were not Agrilcultural College by the law, and to call them so would injure their influence—recommending that they be called National Schools of Science. That would be sensible, and such a name as that would flood us with students. As it is our undiminished patronage is kept up by the Alumni, who beat manfully against public opinion and recommend the institution for what it is, probably the greatest scientific college in the north west.

It will not do to insist that there is nothing in a name. A great deal is in the name we carry—a great deal calculated to foster a mistaken idea in the minds of the people about our College and cripple its usefulness. May we not suggest that the name be changed. The AURORA is most heartily in favor of the management of the College, and believe that in the completeness of its organization and efficiency of its work it takes rank among the very best of its kind in the United States, but it does not believe in the name, and intends to make war on it until it is changed.

The lecture of Prof. Church on "Berlin and its Schools" proved both interesting and instructive. He spoke in the highest terms of the German system of compulsory education, which not only compels the people to pay taxes but applies the money thus gained so that it effectually accomplishes its purpose. It is not strange that with this method of instruction which educates both body and mind, Germany is fast becoming the most powerful government of Europe. The lecture before the Christian Association, on Sabbath evening, was also highly appreciated.

It was our privilege during vacation to visit Mt. Vernon on commencement day of Cornell College. At 9 A. M. the Faculty, Alumni and Seniors, headed by the College band, marched from the main College building to the grove west of the chapel on the campus where the exercises were held. The graduating orations, which were twelve in number, occupied the time, with an intermission for dinner, until half past four. Several of the orations were truly excellent; we noticed that, although from a sectarian school, many of the views expressed were decidedly liberal. One orator deplored that fondness for classical objects which sees more brain power in ancient buildings than in the mighty works of engineering at the the present day; he said that what the world needs is an Age of Steel. In spite of the difficulty of speaking in the open air and against a north wind, the graduates did themselves much credit and reflected honor on their institution. The most attractive building on the grounds is the chapel, which, when completed, will be a magnificent structure. It contains the library, museum, chapel, and a large audience room which is yet unfinished. The society rooms are large and beautifully furnished; one of them has a good sized library in an alcove connected with it. Cornell is truly an institution to be proud of, but we shall return more than ever satisfied with the I. A. C.

It is about the literary societies that cluster many of the pleasing memories of college life. Here it is that the most enduring friendship is founded by means of a mutual struggle in a common cause, that of self-improvement, and the good name of the society. Here all class feeling vanishes, and Seniors and Freshmen unite in the most friendly intercourse on a common level. The society must ever be remembered as the one means by which efficiency was gained in literary work, that most important element in the education of each one. In proportion as these are made the means of calling forth and exercising latent powers and correcting faults in their members will they be accomplishing their true object. That ours are steadily advancing is evinced by the improvements added to the rooms and the interest taken in the exercises; but in connection with the debate there appears, what seems to be a growing evil, the tendency to put force into the voice instead of the argument produced. This practice is not only disagreeable to the audience and annoying to outsiders, but it is a positive injury to the speakers themselves. A cool, carefully prepared argument, in which the points are distinctly set forth in a tone of voice suited to the room in which it is spoken, will always have more weight with the judges than a loud and impassioned argument on the same subject. The effect of deep, well considered points is often massed by this means. We trust that after the subduing effects of vacation, all who plead guilty to this charge will decide that the society halls shall never again echo such unearthly sounds.

Prof. S. S. Hamill has now reached Salt Lake City and finds the people as eager to learn the art of expression as those of Denver. We can understand him when he says an elocutionary wave has struck the country and is rolling over it. Will the teachers believe us when we say an educational wave has struck the country. It is so; and if they have the earnestness that this excellent teacher of elocution has it will raise the people off their feet in enthusiastic hallelujahs. An elocutionist was once asked by a clergyman, "why do the people listen to the most trivial thoughts from you and yet are inattentive when I speak of the most important ones?" "Because," he replied, "I speak my trivial ones as though I believed them; you speak the important ones as though you did not believe them." This is true of teaching. Teachers, where is the educational wave? Why do crowds come with their money to learn to speak properly and you are ready to teach them for nothing? Let us solve the mystery. This man *knows how to teach.*

LOCALS.

—How did you celebrate?

—Programmes? No—Oh, no!

—Junior Exhibition was a grand success.

—Jeff. Davis graduated at West Point in 1828.

—Professor Wynn is spending vacation in the east.

—Miss Athearn intends giving a concert the first of next term.

—An exchange thinks that America has not enough navy to back 'er.

—Jeff. Davis' new book, "The Rise and Fall of the Confederacy," is now in press.

—Flag was at half mast the last evening of the term—must have been put up in a hurry.

—'82 had some very tony programmes. They were gotten up by S. P. Rounds, Chicago.

—The emperor of China, who is now 11 years of age, is suffering from an attack of the measles.

—There has been quite an increase in the number of *posts* this year. The new fence looks immense.

The Alumni historian was able to learn the address of all members of the Alumni except two or three.

—In Russia "hell" is rendered "Tz yakanfitkrajarjanskie," hence the phonograph is preferred to the telephone.

—Out of a class of 55 which started in with Sophomore botany this spring, only three dropped from the class.

—When you return you may expect to see the building looming up bright as a new dollar, with her fresh coat of paint.

—Queen Victoria must be getting short of pocket money. Her old hoes were recently sold at auction in New York.

—From reports it would have been better for Cornell's reputation if the regatta had not allowed them to enter for the centest.

—He was a Junior, and everybody seemed surprised when, as the train left, he said, "Well, I won't hear that *bell* for several weeks."

—Preparations for the fair will commence early next term. We understand the same number will go in the company this year as last.

—The centennial anniversary of the surrender of Lord Cornwallis is to be celebrated on the field of Yorktown, Va., on October 19th.

—Among the number who remain at the College during vacation there is only one young lady, Miss Jennie Perrett, so we are informed.

—One of the features of the Junior exercises most worthy of comment was the duett in German, by Misses Belden and Fiegenbaum.

—She was in earnest and meant just what she was saying, when she remarked, that she thought the crowning feature of the College was *hops*.

—Mr. O. S. Brown, after fording the river and getting a pretty thorough drenching, reached the College in time to partake of the Alumni supper.

—During one of the recent storms the Chemical Laboratory suffered the loss of a chimney, much to the affright of the professor and students.

—Where in the world is there a better place to escape this hot, sweltering July seen that at the I. A. C. We'll all feel gay when "Johnny comes marching home."

—Ladies class in history: *Professor:*—What was the crowning act of Charlmange near the close of his life? *Junior Lady* (taking Sophomore history):—He died.

—In the recent Harvard-Columbia freshman straight-away boat race, Harvard won easily by about three lengths. Time, four minutes, five and three-quarter seconds.

—One of the young ladies circulated her autograph album pretty thoroughly among the young men—she said she didn't sing, but, nevertheless, she was bound to have a *him*-book.

—It was on a general review. He had only studied botany a year, and in reply to the question, "What are epiphytes?" he replied that he could not describe them but that they somewhat resembled an onion.

—In the recent exercises at West Point, it was noticeable, and to us westerners a very pleasing fact, that, on the whole, the western representatives stood at the head of the class.

—The recent eclipse of the moon was taken in by a number of the boys, each one hunting for the most advantageous point of view. Quite a number wandered into the strawberry patch.

—There was quite a scheme sprung upon the lecture association in anticipation of a recent lecturer, but Friday evening is one of the regular study evenings and no encroachments are allowed.

—It isn't always best to try too hard to entertain company; you are apt to get left. That is the conclusion a lady came to, when her sister took in the Junior exercises—while she packed her valise.

—What do the sad sea waves say? on the south side of the building. Even in the midst of vacation, echo seems to come from a Senior's room saying, "Good-night, good-night my lover, good-night, etc."

—The revised edition of the new testament is having quite a sale among the students—it is to be hoped they will post up somewhat. It was a Junior who recently contended that the book of Romans was in the old bible.

—Although there never has been anything of any consequence lost in the College, yet to make assurance doubly sure, the Board purchased a brand new safe, which in workmanship and appearance reflects credit on the Diebold Safe Co.

—In a recent issue of the *Register* we noticed an item saying that "Ed. McDonald had been arraigned for stealing from a colored woman." We were somewhat surprised but concluded it must have been false, as we had not missed Ed.

Professors Stanton and Knapp left for the east the latter part of June, the former going to Pennsylvania and the New England States on a visit, the latter to the Michigan Agricultural College where he had been invited to lecture.

—"Never borrow when you can possibly get along without," is the firm resolution made by Junior after he rushed into his neighbors room and gave his throbbing head a thorough application of linseed oil scented with evergreen.

—It had been the intention to print a summation of the Alumni history in this number, but owing to the scarcity of time and inconvenience of being absent during vacation it has been postponed until next month, when it will be given in a tabulated form.

—Even now and then there are questions asked in class which puzzle the professors. One of the most recent was when a young man, (he boards at the cottage,) asked the professor what an *air-line* was. The professor, having in his earlier day been a special in that line, was able to explain to the enquirer's satisfaction.

—The ladies reserve their domestic economy notes to refute any insinuations against their class or abilities. Any young man who doubts their ability to select material to furnish a house has the privilege to look over the list—when we assure him he will no longer doubt. We, once on a time, looked over the list, it begins with, "one pair of squeezers," and ends with, "a poker and broom."

—The students were recently entertained by the lecture delivered by Geo. E. Church, on "Berlin and its Schools." The lecture was full of interesting and valuable statistics, proving that, thorough as our own schools are, we can learn much from the Germans. His address on "Idol Worship," delivered by request, before the Christian Association, was more calculated to bring forth the speaker's elocution and composition, which both were well shown, and gave even more satisfaction than his first.

—Of all the New England Colleges, Harvard has had the largest addition to her endowment fund during the past year. She has $100,000. Yale has had $250,000, and Dartsmouth, $150,000.

—The class in English Literature having analyzed and discussed three plays of Shakespeare, Hamlet, Macbeth and The Merchant of Venice, were asked to state in the final examination papers to which of the three they were most drawn, ignoring for the time the distinction between tragedy and comedy. The vote when collected stood as follows: For the Merchant of Venice, 16; for Hamlet, 3; for Macbeth, 2.

—Perhaps the most pleasant and valuable trip made by any of students this summer is that being made by our Civil Engineering class. Through the agency of Mr. C. F. Mount, himself and his class, numbering four, were furnished with passes, and left Ames, June 29th, going by rail to Burlington, thence by river to St. Louis and south, taking observations on bridge structures and other constructions coming under their line.

—The scheme for changing the day for holding the graduating exercises is being pretty well worked up and bids fair to be realized within the next two years. This has some great advantages, in that it will allow those who teach to engage fall schools, and those who intend taking either law or medicine, and by our statistics the majority of the graduates do, can go down to Iowa City, or elsewhere, and come out the next spring a full fledged L. L. B.

—The Alumni reunion was indeed a most pleasant and enjoyable affair. Although scarcely more than twenty were in attendance, yet all had a social time during the day, and at evening their regular exercises were attended by the students, who listened with interest to the oration of Mr. Helsell, and history read by Mr. Muncy. After these exercises, they adjourned to partake of their sumptuously prepared supper, after which they elected their officers for the ensuing term and resolved to meet again in two years.

PERSONALS.

'82 Miss Nellie Coe is spending her vacation with Miss Eva Gregg, at Cherokee.

'84. Lee Champion does not intend to return this fall, but will come back in the spring and go through with '84.

'83. Miss Maud Summers came up to the College the last week of the term to visit her friends and brother and take in the Junior X. Miss S. is engaged as assistant in the Malvern high school.

Miss Jessie Noble has gone to Hamburg, Germany, where she intends studying music and the classics.

J. C. Hainer went home to Aurora, Neb., to spend vacation and recruit up while looking over freshman examination papers.

A recent card received from Ben. Barstow was post-marked San Francisco, Cal. Ben is practicing short-hand and studying law.

Miss Hattie Wilson, of Iowa City, and Miss Grace McNeill paid Miss Kate McNeill a very pleasant visit at the close of last term.

ALUMNI.

'80. Montague Hakes came out from Marshall county to hear Schuyler Colfax lecture and have a stroll on the old tenting ground.

'76. The senior member of one of the most successful law firms of Springfield, Ill., is none other than our old friend, Winfield S. Collins.

'79. Again we come to the front with another "*limb* of the law." This time it is the grand successes of Volney Hoggatt that is wafted to the ears of his friends. Vol. is located at Ames.

Among the Alumni who were present at the re-union, besides resident graduates, were Messrs. Hungerford, Columbus Junction, Journalist; Boardman, M. D., Monticello; Booth, Instructor in Deaf and Dumb Assylum, Council Bluffs; Robbins, Professor in Boston School of Technology, Boston, Mass.